

THE DEBATE OVER THE CRETACEOUS-TERTIARY BOUNDARY;
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Large-body impact on the Earth is a rare but indisputable geologic process. The impact rate is approximately known from objects discovered in Earth-crossing orbits and from the statistics of craters on the Earth's surface. Tektite and microtektite strewn fields constitute unmistakable ejecta deposits that can be due only to large-body impacts.

The Cretaceous-Tertiary (K-T) boundary coincides with an unusually severe biological trauma, and this stratigraphic horizon is marked on a worldwide basis by (1) anomalous concentrations of noble metals in chondritic proportions, (2) mineral spherules with relict quench-crystallization textures, and (3) mineral and rock grains showing shock deformation. These features are precisely compatible with an impact origin. Only with difficulty can they be explained by volcanism, and not at all by sea-level change.

Although only impact explains all the types of K-T boundary evidence, the story may not be as simple as once thought. Our original hypothesis envisioned one large impact, triggering one great extinction. Newer evidence hints at various complications: (1) Microstratigraphy in western North America suggests two major impacts within a few years. (2) The Manson crater in Iowa, a good candidate for the source of the shocked quartz, is evidently not big enough to produce a mass extinction. (3) Disturbance of the Oort cloud should produce comet showers with several impacts clustered in a 2-3 Myr interval. (4) The terrestrial cratering record hints at a cluster of impacts near the K-T boundary, but the iridium record does not. (5) The fossil record shows some hints of a stepwise K-T extinction. (6) The K-T event is one member of an apparently periodic sequence of biological traumas and impact crises, suggesting a cyclical astronomical forcing mechanism, such as disruption of the Oort cloud by the hypothetical solar-companion star, Nemesis.

Different challenges are faced by the occupants of each apex of a three-cornered argument over the K-T event. Proponents of a non-impact explanation must show that the evidence fits their preferred model better than it fits the impact scenario. Proponents of the single impact-single extinction view must explain away the complications listed above. Proponents of a more complex impact crisis must develop a reasonable scenario which honors the new evidence.